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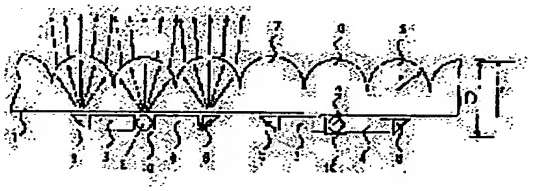
(54) BACK LIGHT

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain source light of high parallelism with extremely thin constitution by arranging a linear light source and a 1st and a 2nd optical path changing means corresponding to optical elements respectively and then arranging light guide bodies between the 1st and 2nd optical path changing means and linear light source.
SOLUTION: The linear light source 2, the left light guide body 3, the right light guide body 4, a left prism 5, a right prism 6, and a reflecting plate 10 are arranged below a surface type optical body 1. The light projection point of the left prism 5, the center line of the linear light source 2, and the light projection point of the right prism 6 are arranged corresponding to cylindrical lenses 7 to 9. Here, the light projection points are arranged almost meeting the focus positions of the cylindrical lenses 7 to 9. Then the left prism 5, left light guide body 3, linear light source 2, right light guide body 4, and right prism 6 constitute one light source guide part and the positions of the three light projection points of the light source guide part are provided corresponding to the respective plano-convex lens parts of the cylindrical lenses 7 to 9.



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CLAIMS

[Claim(s)]
[Claim 1] A linear light source and the field-like enantiomer by which plurality was equipped with the optical element with the condensing reproductive function, It is the back light with which two or more optical probe indices were set as field-like enantiomer corresponding to each optical element. A linear light source, the 1st optical-path modification means, and the 2nd optical-path modification means are arranged corresponding to three optical elements by which continuation arrangement was carried out. The 1st transparent material is arranged between the 1st optical-path modification means and a linear light source, and the 2nd transparent material is arranged between the 2nd optical-path modification means and a linear light source. The 1st flux of light which carried out outgoing radiation from the light source is made to pass the 1st transparent material and the 1st optical-path modification means. The 2nd flux of light which carried out outgoing radiation from the light source is made to pass the 2nd transparent material and the 2nd optical-path modification means. It is the back light characterized by carrying out incidence of the 3rd flux of light which carried out outgoing radiation from the light source to field-like enantiomer, without minding a transparent material, and for the 1st flux of light, the 2nd flux of light, and the 3rd flux of light passing said three optical elements mostly, and carrying out outgoing radiation from field-like enantiomer.
[Claim 2] The back light according to claim 1 which the reflective film is arranged at the tooth-back side of a linear light source, and is characterized by the thickness from the optical outgoing radiation side side of field-like enantiomer to the reflective film being less than 10mm.
[Claim 3] The back light according to claim 1 or 2 which the 1st optical-path modification means and the 2nd optical-path modification means are used as prism, and is characterized by bending an optical path by one side of prism.
[Claim 4] The back light according to claim 1, 2, or 3 characterized by an optical element being a cylindrical lens or a Fresnel lens.
[Claim 5] The back light of claim 1-4 characterized by the pitch of an optical element being 25-100mm given in any 1 term.
[Claim 6] The back light of claim 1-5 characterized by the parallelism of the light by which outgoing radiation is carried out from the field-like enantiomer in an almost perpendicular direction to the longitudinal direction of a linear light source being n>=40 given in any 1 term.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a back light and the display incorporating the back light.
[0002]
[Description of the Prior Art] Outgoing radiation light of a back light is made parallel to one of the means which realizes wide-field-of-view comification of flat-surface mold indicating equipments, such as a liquid crystal display, incidence is carried out to it to a liquid crystal layer, and there is a method of diffusing the light which penetrated the liquid crystal layer with a diffusing screen.
[0003] Generally, a liquid crystal display component shows high contrast to the light of vertical incidence, and shows low contrast to the light by which oblique incidence is carried out to a liquid crystal layer. Therefore, by carrying out parallel Guanghua of the outgoing radiation light of a back light as much as possible, it is prepared so that much light may penetrate a liquid crystal layer on the conditions near vertical incidence.
[0004] The display of high contrast is obtained by this. And if the display light which penetrated the liquid crystal layer on good conditions is diffused with a diffusing screen, the display of high contrast will be obtained also in a slanting line of sight.
[0005] The configuration of the conventional example 1 is shown in drawing 7 . It has the function which carries out parallel Guanghua of the outgoing radiation light from a back light. Incidence of the light emitted from the linear light source 2 which consists of a cold cathode tube is carried out to the transparent material 13 which has the base where halftone dot-like processing [diffusing-surface] was performed. Without fulfilling total reflection conditions, outgoing radiation of the light reflected in the part where diffusing-surface processing was made is carried out upwards, and it carries out incidence to the sheet 14 which has arranged minute prism in the shape of an array. And outgoing radiation light is condensed by the refraction operation in prism.
[0006] Moreover, the configuration of the conventional example 2 is shown in drawing 8 . It has the function which carries out parallel Guanghua of the outgoing radiation light of a back light like the conventional example 1. In this conventional example 2, the transparent material 15 which has not performed diffusing-surface processing, and the optical member 16 which has arranged the microlens in the shape of an array have pasted the base. Although incidence of the light emitted from the linear light source 2 is carried out to a transparent material 15 and it progresses the interior, it is led to a microlens from the adhesion part of a transparent material 15 and the optical member 16. Parallel Guanghua of the outgoing radiation light is carried out by condensing operation of a microlens.
[0007] Moreover, the configuration of the conventional example 3 is shown in drawing 9 . Although it has the function which carries out parallel Guanghua, the configurations differ in the conventional examples 1 and 2. A linear light source, a cylindrical lens, and two or more reflecting plates 15 are formed in the light source section, and it is prepared so that incidence of the light divided into the abbreviation focal location of each lens of the cylindrical lens 17 by the side of an outgoing radiation side may be carried out.
[0008] In this conventional example 3, the thickness of the light source section held in the box became large, and dispersion in the brightness of light arose with the location within a field of a back light, and there was a fault that homogeneity within a field required for a display could not be maintained. Moreover, loss of the light in the light source section could not be disregarded, either, and amelioration was further called for about the comprehensive use effectiveness of light source power, and the luminance distribution and parallelism of outgoing radiation light.
[0009]
[Problem(s) to be Solved by the Invention] However, when using a prism sheet by the technique of the above-mentioned conventional example 1, it was difficult to obtain high parallelism fundamentally. Moreover, outgoing radiation of the secondary peak light of outgoing radiation light was carried out in the direction other than the direction of a transverse plane, and it had the fault that a good display was hard to be obtained.
[0010] Moreover, the structure of pasting up a minute lens on the transparent material of the conventional example 2 had the problem that outgoing radiation of the secondary peak light will be carried out in the direction other than that the use effectiveness of light becomes low, that the member pasted up on a transparent material is complicated, and the direction of a transverse plane.
[0011] Moreover, it was difficult for the use effectiveness of the light source not to be good, and to maintain the homogeneity within a field in the back light of the conventional example 3. Moreover, it was difficult to integral-construction-ize, and it difficult to attain thin shape-ization.
[0012]

[Means for Solving the Problem] This invention is what solves the technical problem which the conventional technique has. Namely, claim 1 A linear light source and the field-like enantiomer by which plurality was equipped with the optical element with the condensing reproductive function, It is the back light with which two or more optical probe indices were set as field-like enantiomer corresponding to each optical element. A linear light source, the 1st optical-path modification means, and the 2nd optical-path modification means are arranged corresponding to three optical elements by which continuation arrangement was carried out. The 1st transparent material is arranged between the 1st optical-path modification means and a linear light source, and the 2nd transparent material is arranged between the 2nd optical-path modification means and a linear light source. The 1st flux of light which carried out outgoing radiation from the light source is made to pass the 1st transparent material and the 1st optical-path modification means. The 2nd flux of light which carried out outgoing radiation from the light source is made to pass the 2nd transparent material and the 2nd optical-path modification means. Incidence of the 3rd flux of light which carried out outgoing radiation from the light source is carried out to field-like enantiomer, without minding a transparent material, and the back light characterized by for the 1st flux of light, the 2nd flux of light, and the 3rd flux of light passing said three optical elements mostly, and outgoing radiation being carried out from field-like enantiomer is offered.

[0013] Moreover, the reflective film is arranged at the tooth-back side of a linear light source, and claim 2 offers the back light according to claim 1 characterized by the thickness from the optical outgoing radiation side side of field-like enantiomer to the reflective film being less than 10mm.

[0014] Moreover, claim 3 offers the back light according to claim 1 or 2 which the 1st optical-path modification means and the 2nd optical-path modification means are used as prism, and is characterized by bending an optical path by one side of prism.

[0015] Moreover, claim 4 offers the back light according to claim 1, 2, or 3 characterized by an optical element being a cylindrical lens or a Fresnel lens.

[0016] Moreover, claim 5 offers the back light of claim 1-4 characterized by the pitch of an optical element being 25-100mm given in any 1 term.

[0017] Moreover, claim 6 offers the back light of claim 1-5 characterized by the parallelism of the light by which outgoing radiation is carried out from field-like enantiomer in an almost perpendicular direction being n>=40 given in any 1 term to the longitudinal direction of a linear light source.

[0018] It is still more desirable to arrange the optical element which also equips the longitudinal direction of the filament light source with the condensing reproductive function. In this case, parallelism can be improved also in any of the plane rectangular direction. Moreover, the display equipped with the above-mentioned back light and the liquid crystal display combined with TN, STN, and the liquid crystal display component of a TFT mold are offered preferably.

[0019]

[Embodiment of the Invention] Drawing 1 is the sectional view of one example of this invention. The field-like enantiomer 1 of thickness t arranges the cylindrical lenses 7, 8, and 9 with the cross section of an one direction with a flat surface planoconvex to a cylinder side [of a radius r], and tooth-back side in the shape of an array on a side front. Drawing 1 shows the cross section in a direction perpendicular to the longitudinal direction of a cylindrical configuration.

[0020] The linear light source 2 which is a cold cathode tube under the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, the right-hand side prism 6, and a reflecting plate 10 have been arranged. Respectively corresponding to cylindrical lenses 7, 8, and 9, the light emission launch complex of the left-hand side prism 5, the center line of the filament light source 2, and the light emission launch complex of the right-hand side prism 6 have been arranged. Moreover, light emission launch complex has been arranged so that it may agree in the abbreviation focal location of a cylindrical lens.

[0021] Thickness from the maximum convex location of the convex of a cylindrical lens to a reflecting plate is set to D. In addition, although a right-hand side transparent material and a left-hand side transparent material are [2nd] equivalent to the 1st transparent material of the above-mentioned claim, and a transparent material and can also change and prepare both dimension, usually preparing equally [right and left] is desirable.

[0022] 1 set of light source light guide sections were constituted from the left-hand side prism 5 and the left-hand side transparent material 3, a linear light source 2, a right-hand side transparent material 4, and right-hand side prism 6, and the location of three light emission launch complex (beam-of-light group shown in the left-hand side of drawing 1 by the arrow head) of a light source light guide section was prepared respectively corresponding to each plano-convex lens section of cylindrical lenses 7, 8, and 9. Although based on the magnitude of the screen required for a display, and the pitch of the cylindrical lens to a pixel, at least 10-20 sets of light source light guide sections are prepared as a whole.

[0023] In addition, according to a linear light source, a transparent material and prism have the linear structure of having a longitudinal direction. From a viewpoint on manufacture, you may **** and the thing of die length almost equal to a linear light source may be prepared.

[0024] Drawing 2 is the partial enlarged drawing of a light source light guide section, and is the ray-tracing Fig. showing the process in which the light by which outgoing radiation was carried out from the linear light source carries out outgoing radiation from the right-hand side transparent material 4 and the right-hand side prism 6. Width of face of the right-hand side transparent material 4 is set to a, and height is set to b. The cross section of left-hand side prism is made into a rectangular equilateral triangle, and sets the die length of the shorter side to c. A

cross section is an approximate circle form and the cold cathode tube used as a linear light source 2 sets the diameter to d. The flux of light L1 among the light by which outgoing radiation was carried out from the linear light source 2 by drawing 2 , L2, L3, and L4 The optical path is shown.

[0025] As shown in drawing 1 , after carrying out direct incidence to the left-hand side transparent material 3, the right-hand side transparent material 4, and a cylindrical lens 8 or being reflected with a reflecting plate 10, incidence of the light emitted from the linear light source 2 is carried out to the left-hand side transparent material 3 and the right-hand side transparent material 4. Parallel Guanghua of the light which carried out incidence to the cylindrical lens 8 is carried out by condensing operation of a cylindrical lens, and it carries out outgoing radiation to a liquid crystal layer (upper part).

[0026] Incidence of the light which carried out incidence to the left-hand side transparent material 3 is carried out to the left-hand side prism 5, it is led to the cylindrical lens 7 arranged above the left-hand side prism 5, parallel Guanghua is further carried out by condensing operation of a cylindrical lens 7, and outgoing radiation is carried out in a liquid crystal layer (upper part). Incidence of the light which carried out incidence to the right-hand side transparent material 4 similarly is carried out to the right-hand side prism 6, it is led to the cylindrical lens 9 arranged above the right-hand side prism 6, parallel Guanghua is further carried out by condensing operation of a cylindrical lens 9, and outgoing radiation is carried out in a liquid crystal layer (upper part).

[0027] Polymeric materials, glass, etc. which each shows high transparency optically are used for the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, and the right-hand side prism 6. Aluminum and silver are vapor-deposited in the slant face of the left-hand side prism 5 and the right-hand side prism 6, and the good reflector which does not make light penetrate is established in it. It is desirable to use metallic materials with a high reflection factor, such as aluminum and silver, also about a reflecting plate 10.

[0028] The field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, and the right-hand side prism 6 are arranged without contacting each other. Under the present circumstances, it is desirable to make the air space between members as thin as possible. For example, what is necessary is just to arrange so that an about 0.5-1.5mm opening may be prepared and a transparent material and prism may be supported at the edge.

[0029] Or the ingredient (for example, the copolymer (number average molecular weight about 3x105) of PBVE and perfluoro (the 2 and 2-dimethyl -1, 3-JIOKI SOL) [PDD] etc. is raised as matter of a refractive index 1.34 as the polymer (number average molecular weight about 1.5x105) of perfluoro (butenyl vinyl ether) [PBVE] and matter of a refractive index 1.29.) of a low refractive index may be arranged on the front face of a transparent material and prism. Fundamentally, in order to control the leakage of the light from a transparent material and the interior of prism, it is desirable to adjust and establish the refractive-index difference of a transparent material and prism, and the member that encloses it so that total reflection conditions may be satisfied.

[0030] Usually, if a transparent material and prism prepare an opening on the outskirts with air (refractive-index **1.0) using acrylic resin, good flux of light transmission conditions with little loss will be fulfilled simple [manufacture]. And it is because system-wide efficiency for light utilization improves further. Moreover, the cylindrical lenses 7, 8, and 9 arranged in the shape of an array are a part of field-like enantiomers 1, and are in the physical relationship which continues spatially.

[0031] The topmost part (advance core of the flux of light) of the left-hand side prism 5 is arranged, and the topmost part (to this appearance, it is the advance core of the flux of light) of the right-hand side prism 6 is arranged for the topmost part of a linear light source 2 near the focus of a cylindrical lens 9 near the focus of a cylindrical lens 7 near the focus of a cylindrical lens 8. Between a linear light source 2 and the left-hand side prism 5, the left-hand side transparent material 3 is arranged, and the right-hand side transparent material 4 is arranged between a linear light source 2 and the right-hand side prism 6. Moreover, a reflecting plate 10 is arranged so that the bottom of a linear light source 2 may be touched mostly.

[0032] If the unit which has such an optical control function, i.e., a cold cathode tube, two transparent materials, two prism, and the unit that consists of a reflecting plate are arranged in two or more juxtaposition to field-like enantiomer with an array-like cylindrical lens, the back light which supplies the outgoing radiation light by which parallel Guanghua was carried out to the whole screen is realizable.

[0033] In a process until the light which carried out [light] outgoing radiation from the light-emitting part of the light source, and carried out incidence, respectively to the left-hand side transparent material 3 and the right-hand side transparent material 4 carries out outgoing radiation of a cylindrical lens 7 and the cylindrical lens 9, respectively, although the quantity of light is lost by the reflection in the boundary of a transparent material and air, the reflection in the boundary of prism and air, and absorption in a prism slant face (vacuum-plating-of-aluminium side), as for the rate, the desired flux of light can be substantially taken out as a back light small.

[0034] Moreover, to a cylindrical lens 8, incidence of the light reflected by the reflecting plate 10 is not carried out, but it almost carries out incidence to the left-hand side transparent material 3 and the right-hand side transparent material 4. Therefore, through the quantity of light by which outgoing radiation is carried out from a cylindrical lens 8, and the transparent material and prism of one of right and left, there are few differences with the quantity of light in which outgoing radiation is carried out by a cylindrical lens 7 and the cylindrical lens 9, and they can maintain the homogeneity in the screen of the outgoing radiation quantity of light.

[0035] The linear light source 2 is arranged so that it may be surrounded by the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, and the reflecting plate 10, it can

supply most light emitted from the linear light source 2 to cylindrical lenses 7, 8, and 9, and can realize high efficiency for light utilization.
[0036] By taking the sufficiently large size of cylindrical lenses 7, 8, and 9 to a linear light source 2 or two prism, the parallelism of the outgoing radiation light from a back light can be raised, and the outgoing radiation of secondary peak light can be stopped. Moreover, the description of this invention is in how to combine two or more members, and each member which constitutes a back light has the simple configuration. Therefore, high productivity is expected even if it faces mass production.
[0037] Moreover, on the occasion of operation of this invention, the thing of other gestalten can also be used instead of the above-mentioned field-like enantiomer. Drawing 4 is a sectional view showing the gestalt of other operations of this invention. The field-like enantiomer 11 which has arranged the cylindrical lens of both convexes in the shape of an array is used for a different point from drawing 1 instead of the field-like enantiomer 1. Near the focus of each cylindrical lens, the topmost part of a linear light source 2, the topmost part of the left-hand side prism 5, and the topmost part of the right-hand side prism 6 are arranged.
[0038] It is the sectional view where drawing 5 also expresses the gestalt of other operations of this invention. A different point from drawing 1 is to use the field-like enantiomer 12 which has arranged the Fresnel lens in the shape of an array instead of the field-like enantiomer 1. Near the focus of each Fresnel lens, the topmost part of a linear light source 2, the topmost part of the left-hand side prism 5, and the topmost part of the right-hand side prism 6 are arranged. This approach controls thickness t of field-like enantiomer, and has the advantage that super-thin shape-ization can be attained. And-izing also of the whole thickness D can be carried out [thin shape].
[0039]
[Example]
(Example 1) This example is the thing of the structure shown in drawing 1 , and set the radius of the cylinder side of a cylindrical lens as the thickness of t= 8mm of r= 4mm and the field-like enantiomer 1, width of face of a= 5.9mm of each transparent material, height of b= 2mm of each transparent material, die length of c= 2mm of the shorter side of each prism, the diameter of d= 2mm of a cold cathode tube, and the whole thickness of D= 11mm.
[0040] The parallelism of outgoing radiation light increases, so that a lens is generally large compared with a light source light guide section (the path of a cold cathode tube and the dimension of prism when it is this example). In the case of the above-mentioned set point, the ratio of r and d or the ratio of r and c was 2:1, but simulation estimated the parallelism of the back light outgoing radiation light in this condition. Drawing 6 shows the accumulation quantity of light curve of the outgoing radiation light at the time of setting a lens radius and width of face of an optical source of supply to 2:1.
[0041] An accumulation quantity of light curve integrates with the outgoing radiation quantity of light about an outgoing radiation include angle, and a curve starts, so that parallelism is high. The parallelism at the time of carrying out a lens radius and width of face of an optical source of supply 2:1 is I=IO and cosn theta as a result of ray-tracing count. In ... (formula 1), it corresponded, when it placed with n= 50, and it checked that high parallelism was obtained. In addition, it is desirable to constitute so that it may be set to n>=40 in this invention.
[0042] The formula 1 expresses the luminous-intensity distribution according to outgoing radiation include angle of the general surface light source. Setting at this ceremony, I is luminous intensity and IO. The luminous intensity of the outgoing radiation light of the direction of a transverse plane and theta are outgoing radiation include angles, and the parallelism of outgoing radiation light increases, so that n is large (when referred to as n= 1, it is the perfect diffusion light source).
[0043] What is necessary is just to define the optimal dimension from the parallelism called for in fact, the permissible thickness of field-like enantiomer, the size of the screen, etc., although the ratio of the radius of the cylinder side of a cylindrical lens and a cold cathode tube diameter was set to 2:1 in this example.
[0044] (Example 2) The example which united edge 5' on either side, 6', light guide body section 3' on either side, and 4' with drawing 3 , respectively is shown. Although the use effectiveness of light was inferior to the above-mentioned example a little in this example, the structure of a light source light guide section could be simplified, and manufacture was easy. The edge slant face of the unified structure functions as an optical-path modification means.

[0045]
[Effect of the Invention] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without spoiling the homogeneity of the brightness in the screen.
[0046] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, stopping the outgoing radiation of secondary peak light.
[0047] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without reducing efficiency for light utilization.
[0048] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out with the combination of the field-like enantiomer which has a comparatively easy configuration. And super-thin shape-ization can be attained and it can contribute to the miniaturization of a display. Moreover, the overall efficiency of the light source can be improved sharply, even if it is little light source power, a good display can be offered, and even if it is cell actuation, the effective time can be lengthened.
[0049] Moreover, according to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without increasing the thickness of a back light. Moreover, this invention can perform application various in the range which does not lose the effectiveness.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to a back light and the display incorporating the back light.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Outgoing radiation light of a back light is made parallel to one of the means which realizes wide-field-of-view comification of flat-surface mold indicating equipments, such as a liquid crystal display, incidence is carried out to it to a liquid crystal layer, and there is a method of diffusing the light which penetrated the liquid crystal layer with a diffusing screen.

[0003] Generally, a liquid crystal display component shows high contrast to the light of vertical incidence, and shows low contrast to the light by which oblique incidence is carried out to a liquid crystal layer. Therefore, by carrying out parallel Guanghua of the outgoing radiation light of a back light as much as possible, it is prepared so that much light may penetrate a liquid crystal layer on the conditions near vertical incidence.

[0004] The display of high contrast is obtained by this. And if the display light which penetrated the liquid crystal layer on good conditions is diffused with a diffusing screen, the display of high contrast will be obtained also in a slanting line of sight.

[0005] The configuration of the conventional example 1 is shown in drawing 7 . It has the function which carries out parallel Guanghua of the outgoing radiation light from a back light. Incidence of the light emitted from the linear light source 2 which consists of a cold cathode tube is carried out to the transparent material 13 which has the base where halftone dot-like processing [diffusing-surface] was performed. Without fulfilling total reflection conditions, outgoing radiation of the light reflected in the part where diffusing-surface processing was made is carried out upwards, and it carries out incidence to the sheet 14 which has arranged minute prism in the shape of an array. And outgoing radiation light is condensed by the refraction operation in prism.

[0006] Moreover, the configuration of the conventional example 2 is shown in drawing 8 . It has the function which carries out parallel Guanghua of the outgoing radiation light of a back light like the conventional example 1. In this conventional example 2, the transparent material 15 which has not performed diffusing-surface processing, and the optical member 16 which has arranged the microlens in the shape of an array have pasted the base. Although incidence of the light emitted from the linear light source 2 is carried out to a transparent material 15 and it progresses the interior, it is led to a microlens from the adhesion part of a transparent material 15 and the optical member 16. Parallel Guanghua of the outgoing radiation light is carried out by condensing operation of a microlens.

[0007] Moreover, the configuration of the conventional example 3 is shown in drawing 9 . Although it has the function which carries out parallel Guanghua, the configurations differ in the conventional examples 1 and 2. A linear light source, a cylindrical lens, and two or more reflecting plates 15 are formed in the light source section, and it is prepared so that incidence of the light divided into the abbreviation focal location of each lens of the cylindrical lens 17 by the side of an outgoing radiation side may be carried out.

[0008] In this conventional example 3, the thickness of the light source section held in the box became large, and dispersion in the brightness of light arose with the location within a field of a back light, and there was a fault that homogeneity within a field required for a display could not be maintained. Moreover, loss of the light in the light source section could not be disregarded, either, and amelioration was further called for about the comprehensive use effectiveness of light source power, and the luminance distribution and parallelism of outgoing radiation light.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without spoiling the homogeneity of the brightness in the screen.
[0046] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, stopping the outgoing radiation of secondary peak light.
[0047] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without reducing efficiency for light utilization.
[0048] According to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out with the combination of the field-like enantiomer which has a comparatively easy configuration. And super-thin shape-ization can be attained and it can contribute to the miniaturization of a display. Moreover, the overall efficiency of the light source can be improved sharply, even if it is little light source power, a good display can be offered, and even if it is cell actuation, the effective time can be lengthened.
[0049] Moreover, according to this invention, parallel Guanghua of the back light outgoing radiation light can be carried out, without increasing the thickness of a back light. Moreover, this invention can perform application various in the range which does not lose the effectiveness.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when using a prism sheet by the technique of the above-mentioned conventional example 1, it was difficult to obtain high parallelism fundamentally. Moreover, outgoing radiation of the secondary peak light of outgoing radiation light was carried out in the direction other than the direction of a transverse plane, and it had the fault that a good display was hard to be obtained.
[0010] Moreover, the structure of pasting up a minute lens on the transparent material of the conventional example 2 had the problem that outgoing radiation of the secondary peak light will be carried out in the direction other than that the use effectiveness of light becomes low, that the member pasted up on a transparent material is complicated, and the direction of a transverse plane.
[0011] Moreover, it was difficult for the use effectiveness of the light source not to be good, and to maintain the homogeneity within a field in the back light of the conventional example 3. Moreover, it was difficult to integral-construction-ize, and it difficult to attain thin shape-ization.

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MEANS

[Means for Solving the Problem] This invention is what solves the technical problem which the conventional technique has. Namely, claim 1 A linear light source and the field-like enantiomer by which plurality was equipped with the optical element with the condensing reproductive function, It is the back light with which two or more optical probe indices were set as field-like enantiomer corresponding to each optical element. A linear light source, the 1st optical-path modification means, and the 2nd optical-path modification means are arranged corresponding to three optical elements by which continuation arrangement was carried out. The 1st transparent material is arranged between the 1st optical-path modification means and a linear light source, and the 2nd transparent material is arranged between the 2nd optical-path modification means and a linear light source. The 1st flux of light which carried out outgoing radiation from the light source is made to pass the 1st transparent material and the 1st optical-path modification means. The 2nd flux of light which carried out outgoing radiation from the light source is made to pass the 2nd transparent material and the 2nd optical-path modification means. Incidence of the 3rd flux of light which carried out outgoing radiation from the light source is carried out to field-like enantiomer, without minding a transparent material, and the back light characterized by for the 1st flux of light, the 2nd flux of light, and the 3rd flux of light passing said three optical elements mostly, and outgoing radiation being carried out from field-like enantiomer is offered.
[0013] Moreover, the reflective film is arranged at the tooth-back side of a linear light source, and claim 2 offers the back light according to claim 1 characterized by the thickness from the optical outgoing radiation side side of field-like enantiomer to the reflective film being less than 10mm.
[0014] Moreover, claim 3 offers the back light according to claim 1 or 2 which the 1st optical-path modification means and the 2nd optical-path modification means are used as prism, and is characterized by bending an optical path by one side of prism.
[0015] Moreover, claim 4 offers the back light according to claim 1, 2, or 3 characterized by an optical element being a cylindrical lens or a Fresnel lens.
[0016] Moreover, claim 5 offers the back light of claim 1-4 characterized by the pitch of an optical element being 25-100mm given in any 1 term.
[0017] Moreover, claim 6 offers the back light of claim 1-5 characterized by the parallelism of the light by which outgoing radiation is carried out from field-like enantiomer in an almost perpendicular direction being n>=40 given in any 1 term to the longitudinal direction of a linear light source.
[0018] It is still more desirable to arrange the optical element which also equips the longitudinal direction of the filament light source with the condensing reproductive function. In this case, parallelism can be improved also in any of the plane rectangular direction. Moreover, the display equipped with the above-mentioned back light and the liquid crystal display combined with TN, STN, and the liquid crystal display component of a TFT mold are offered preferably.
[0019]
[Embodiment of the Invention] Drawing 1 is the sectional view of one example of this invention. The field-like enantiomer 1 of thickness t arranges the cylindrical lenses 7, 8, and 9 with the cross section of an one direction with a flat surface planoconvex to a cylinder side [of a radius r], and tooth-back side in the shape of an array on a side front. Drawing 1 shows the cross section in a direction perpendicular to the longitudinal direction of a cylindrical configuration.
[0020] The linear light source 2 which is a cold cathode tube under the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, the right-hand side prism 6, and a reflecting plate 10 have been arranged. Respectively corresponding to cylindrical lenses 7, 8, and 9, the light emission launch complex of the left-hand side prism 5, the center line of the filament light source 2, and the light emission launch complex of the right-hand side prism 6 have been arranged. Moreover, light emission launch complex has been arranged so that it may agree in the abbreviation focal location of a cylindrical lens.
[0021] Thickness from the maximum convex location of the convex of a cylindrical lens to a reflecting plate is set to D. In addition, although a right-hand side transparent material and a left-hand side transparent material are [2nd] equivalent to the 1st transparent material of the above-mentioned claim, and a transparent material and can also change and prepare both dimension, usually preparing equally [right and left] is desirable.
[0022] 1 set of light source light guide sections were constituted from the left-hand side prism 5 and the left-hand side transparent material 3, a linear light source 2, a right-hand side transparent material 4, and right-hand side prism 6, and the location of three light emission launch complex (beam-of-light group shown in the left-hand side of

drawing 1 by the arrow head) of a light source light guide section was prepared respectively corresponding to each plano-convex lens section of cylindrical lenses 7, 8, and 9. Although based on the magnitude of the screen required for a display, and the pitch of the cylindrical lens to a pixel, at least 10-20 sets of light source light guide sections are prepared as a whole.

[0023] In addition, according to a linear light source, a transparent material and prism have the linear structure of having a longitudinal direction. From a viewpoint on manufacture, you may **** and the thing of die length almost equal to a linear light source may be prepared.

[0024] Drawing 2 is the partial enlarged drawing of a light source light guide section, and is the ray-tracing Fig. showing the process in which the light by which outgoing radiation was carried out from the linear light source carries out outgoing radiation from the right-hand side transparent material 4 and the right-hand side prism 6. Width of face of the right-hand side transparent material 4 is set to a, and height is set to b. The cross section of left-hand side prism is made into a rectangular equilateral triangle, and sets the die length of the shorter side to c. A cross section is an approximate circle form and the cold cathode tube used as a linear light source 2 sets the diameter to d. The flux of light L1 among the light by which outgoing radiation was carried out from the linear light source 2 by drawing 2 , L2, L3, and L4 The optical path is shown.

[0025] As shown in drawing 1 , after carrying out direct incidence to the left-hand side transparent material 3, the right-hand side transparent material 4, and a cylindrical lens 8 or being reflected with a reflecting plate 10, incidence of the light emitted from the linear light source 2 is carried out to the left-hand side transparent material 3 and the right-hand side transparent material 4. Parallel Guanghua of the light which carried out incidence to the cylindrical lens 8 is carried out by condensing operation of a cylindrical lens, and it carries out outgoing radiation to a liquid crystal layer (upper part).

[0026] Incidence of the light which carried out incidence to the left-hand side transparent material 3 is carried out to the left-hand side prism 5, it is led to the cylindrical lens 7 arranged above the left-hand side prism 5, parallel Guanghua is further carried out by condensing operation of a cylindrical lens 7, and outgoing radiation is carried out in a liquid crystal layer (upper part). Incidence of the light which carried out incidence to the right-hand side transparent material 4 similarly is carried out to the right-hand side prism 6, it is led to the cylindrical lens 9 arranged above the right-hand side prism 6, parallel Guanghua is further carried out by condensing operation of a cylindrical lens 9, and outgoing radiation is carried out in a liquid crystal layer (upper part).

[0027] Polymeric materials, glass, etc. which each shows high transparency optically are used for the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, and the right-hand side prism 6. Aluminum and silver are vapor-deposited in the slant face of the left-hand side prism 5 and the right-hand side prism 6, and the good reflector which does not make light penetrate is established in it. It is desirable to use metallic materials with a high reflection factor, such as aluminum and silver, also about a reflecting plate 10.

[0028] The field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, the left-hand side prism 5, and the right-hand side prism 6 are arranged without contacting each other. Under the present circumstances, it is desirable to make the air space between members as thin as possible. For example, what is necessary is just to arrange so that an about 0.5-1.5mm opening may be prepared and a transparent material and prism may be supported at the edge.

[0029] Or the ingredient (for example, the copolymer (number average molecular weight about 3x105) of PBVE and perfluoro (the 2 and 2-dimethyl -1, 3-JIOKI SOL) [PDD] etc. is raised as matter of a refractive index 1.34 as the polymer (number average molecular weight about 1.5x105) of perfluoro (butenyl vinyl ether) [PBVE] and matter of a refractive index 1.29.) of a low refractive index may be arranged on the front face of a transparent material and prism. Fundamentally, in order to control the leakage of the light from a transparent material and the interior of prism, it is desirable to adjust and establish the refractive-index difference of a transparent material and prism, and the member that encloses it so that total reflection conditions may be satisfied.

[0030] Usually, if a transparent material and prism prepare an opening on the outskirts with air (refractive-index **1.0) using acrylic resin, good flux of light transmission conditions with little loss will be fulfilled simple [manufacture]. And it is because system-wide efficiency for light utilization improves further. Moreover, the cylindrical lenses 7, 8, and 9 arranged in the shape of an array are a part of field-like enantiomers 1, and are in the physical relationship which continues spatially.

[0031] The topmost part (advance core of the flux of light) of the left-hand side prism 5 is arranged, and the topmost part (to this appearance, it is the advance core of the flux of light) of the right-hand side prism 6 is arranged for the topmost part of a linear light source 2 near the focus of a cylindrical lens 9 near the focus of a cylindrical lens 7 near the focus of a cylindrical lens 8. Between a linear light source 2 and the left-hand side prism 5, the left-hand side transparent material 3 is arranged, and the right-hand side transparent material 4 is arranged between a linear light source 2 and the right-hand side prism 6. Moreover, a reflecting plate 10 is arranged so that the bottom of a linear light source 2 may be touched mostly.

[0032] If the unit which has such an optical control function, i.e., a cold cathode tube, two transparent materials, two prism, and the unit that consists of a reflecting plate are arranged in two or more juxtaposition to field-like enantiomer with an array-like cylindrical lens, the back light which supplies the outgoing radiation light by which parallel Guanghua was carried out to the whole screen is realizable.

[0033] In a process until the light which carried out [light] outgoing radiation from the light-emitting part of the light source, and carried out incidence, respectively to the left-hand side transparent material 3 and the right-hand

side transparent material 4 carries out outgoing radiation of a cylindrical lens 7 and the cylindrical lens 9, respectively, although the quantity of light is lost by the reflection in the boundary of a transparent material and air, the reflection in the boundary of prism and air, and absorption in a prism slant face (vacuum-plating-of-aluminium side), as for the rate, the desired flux of light can be substantially taken out as a back light small.

[0034] Moreover, to a cylindrical lens 8, incidence of the light reflected by the reflecting plate 10 is not carried out, but it almost carries out incidence to the left-hand side transparent material 3 and the right-hand side transparent material 4. Therefore, through the quantity of light by which outgoing radiation is carried out from a cylindrical lens 8, and the transparent material and prism of one of right and left, there are few differences with the quantity of light in which outgoing radiation is carried out by a cylindrical lens 7 and the cylindrical lens 9, and they can maintain the homogeneity in the screen of the outgoing radiation quantity of light.

[0035] The linear light source 2 is arranged so that it may be surrounded by the field-like enantiomer 1, the left-hand side transparent material 3, the right-hand side transparent material 4, and the reflecting plate 10, it can supply most light emitted from the linear light source 2 to cylindrical lenses 7, 8, and 9, and can realize high efficiency for light utilization.

[0036] By taking the sufficiently large size of cylindrical lenses 7, 8, and 9 to a linear light source 2 or two prism, the parallelism of the outgoing radiation light from a back light can be raised, and the outgoing radiation of secondary peak light can be stopped. Moreover, the description of this invention is in how to combine two or more members, and each member which constitutes a back light has the simple configuration. Therefore, high productivity is expected even if it faces mass production.

[0037] Moreover, on the occasion of operation of this invention, the thing of other gestalten can also be used instead of the above-mentioned field-like enantiomer. Drawing 4 is a sectional view showing the gestalt of other operations of this invention. The field-like enantiomer 11 which has arranged the cylindrical lens of both convexes in the shape of an array is used for a different point from drawing 1 instead of the field-like enantiomer 1. Near the focus of each cylindrical lens, the topmost part of a linear light source 2, the topmost part of the left-hand side prism 5, and the topmost part of the right-hand side prism 6 are arranged.

[0038] It is the sectional view where drawing 5 also expresses the gestalt of other operations of this invention. A different point from drawing 1 is to use the field-like enantiomer 12 which has arranged the Fresnel lens in the shape of an array instead of the field-like enantiomer 1. Near the focus of each Fresnel lens, the topmost part of a linear light source 2, the topmost part of the left-hand side prism 5, and the topmost part of the right-hand side prism 6 are arranged. This approach controls thickness t of field-like enantiomer, and has the advantage that super-thin shape-ization can be attained. And-izing also of the whole thickness D can be carried out [thin shape].

[Translation done.]

* NOTICES *

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EXAMPLE

[Example]
(Example 1) This example is the thing of the structure shown in drawing 1 , and set the radius of the cylinder side of a cylindrical lens as the thickness of t= 8mm of r= 4mm and the field-like enantiomer 1, width of face of a= 5.9mm of each transparent material, height of b= 2mm of each transparent material, die length of c= 2mm of the shorter side of each prism, the diameter of d= 2mm of a cold cathode tube, and the whole thickness of D= 11mm.
[0040] The parallelism of outgoing radiation light increases, so that a lens is generally large compared with a light source light guide section (the path of a cold cathode tube and the dimension of prism when it is this example). In the case of the above-mentioned set point, the ratio of r and d or the ratio of r and c was 2:1, but simulation estimated the parallelism of the back light outgoing radiation light in this condition. Drawing 6 shows the accumulation quantity of light curve of the outgoing radiation light at the time of setting a lens radius and width of face of an optical source of supply to 2:1.
[0041] An accumulation quantity of light curve integrates with the outgoing radiation quantity of light about an outgoing radiation include angle, and a curve starts, so that parallelism is high. The parallelism at the time of carrying out a lens radius and width of face of an optical source of supply 2:1 is I=IO and cosn theta as a result of ray-tracing count. In ... (formula 1), it corresponded, when it placed with n= 50, and it checked that high parallelism was obtained. In addition, it is desirable to constitute so that it may be set to n>=40 in this invention.
[0042] The formula 1 expresses the luminous-intensity distribution according to outgoing radiation include angle of the general surface light source. Setting at this ceremony, I is luminous intensity and IO. The luminous intensity of the outgoing radiation light of the direction of a transverse plane and theta are outgoing radiation include angles, and the parallelism of outgoing radiation light increases, so that n is large (when referred to as n= 1, it is the perfect diffusion light source).
[0043] What is necessary is just to define the optimal dimension from the parallelism called for in fact, the permissible thickness of field-like enantiomer, the size of the screen, etc., although the ratio of the radius of the cylinder side of a cylindrical lens and a cold cathode tube diameter was set to 2:1 in this example.
[0044] (Example 2) The example which united edge 5' on either side, 6', light guide body section 3' on either side, and 4' with drawing 3 , respectively is shown. Although the use effectiveness of light was inferior to the above-mentioned example a little in this example, the structure of a light source light guide section could be simplified, and manufacture was easy. The edge slant face of the unified structure functions as an optical-path modification means.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the back light of the example 1 of this invention.
[Drawing 2] The partial expanded sectional view showing the optical path of the light source light guide section which constitutes the back light by this invention.
[Drawing 3] The sectional view of the example 2 (a transparent material and prism one apparatus) of this invention.
[Drawing 4] The sectional view of other examples (both convex cylindrical lens) of this invention.
[Drawing 5] The sectional view of other examples (Fresnel lens) of this invention.
[Drawing 6] The accumulation quantity of light curve of the back light outgoing radiation light for which it asked with ray tracing.
[Drawing 7] The sectional view of the conventional example 1 using a prism sheet.
[Drawing 8] The sectional view of the conventional example 2 which pastes up a spherical lens on a transparent material.
[Drawing 9] The sectional view of the conventional example 3 which performs division of a cylindrical lens and light source light.
[Description of Notations]
1, 11, 12: Field-like enantiomer
2: Linear light source
3: Left-hand side transparent material
4: Right-hand side transparent material
5: Left-hand side prism
6: Right-hand side prism
7, 8, 9: Cylindrical lens
10: Reflecting plate

[Translation done.]

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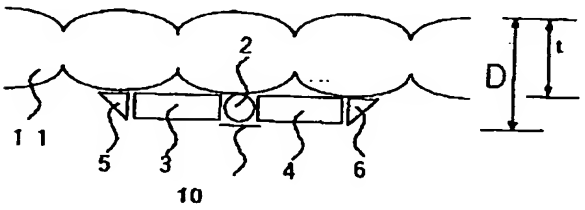
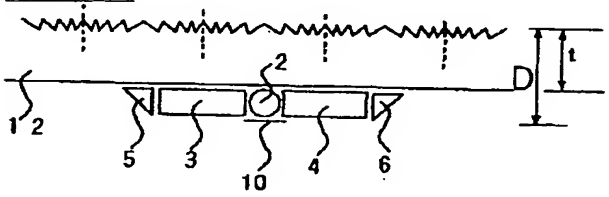
DRAWINGS

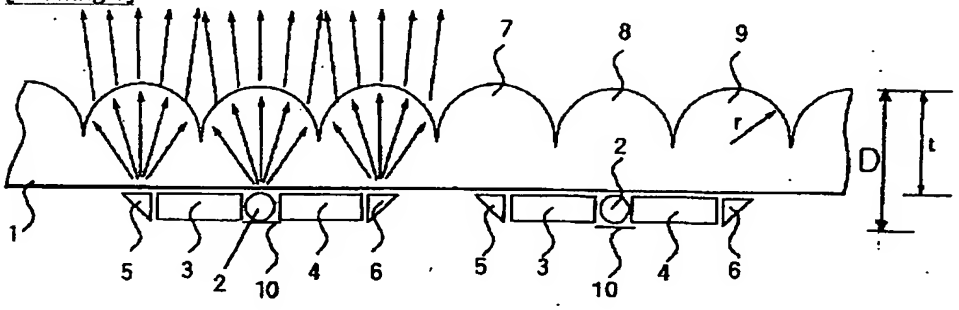
[Drawing 4]



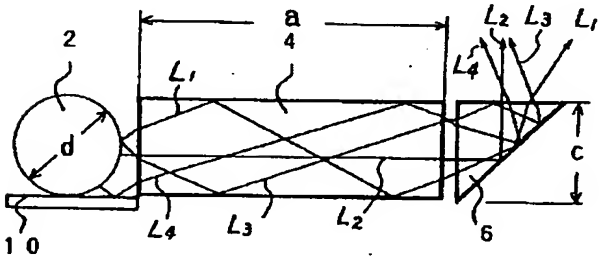
[Drawing 5]



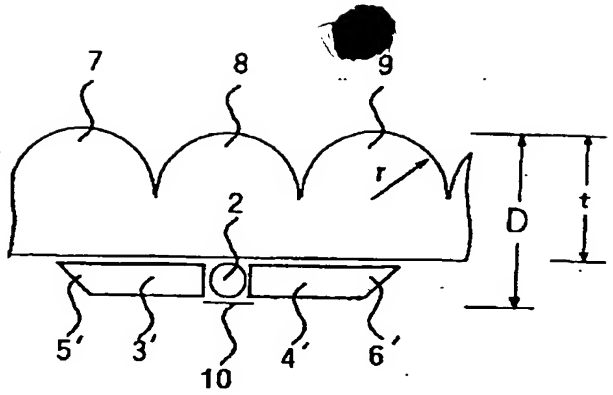
[Drawing 1]



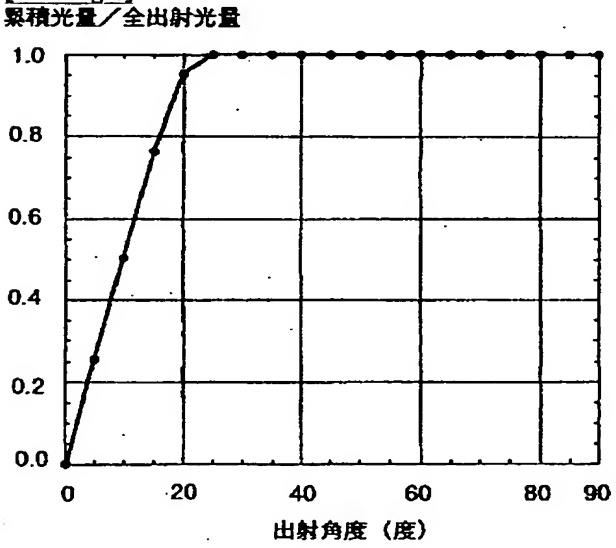
[Drawing 2]



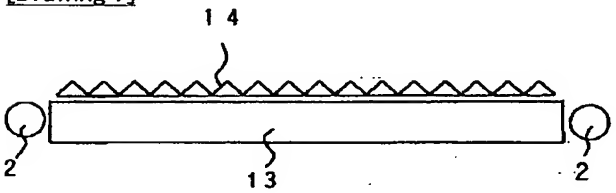
[Drawing 3]



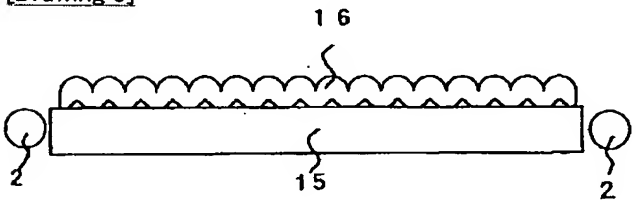
[Drawing 6]



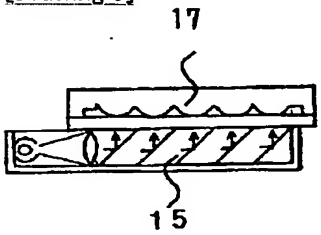
[Drawing 7]



[Drawing 8]



[Drawing 9]



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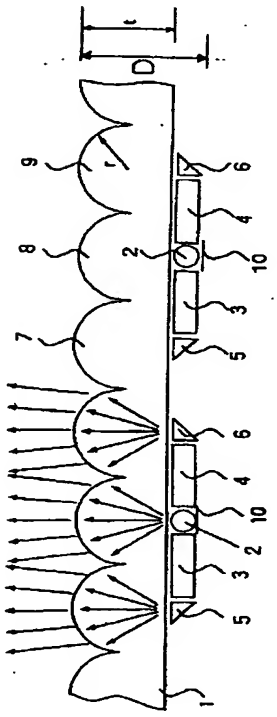
最終頁に続く

(54)【発明の名称】　バックライト

(57)【要約】
【課題】超薄型の部材構成で高い平行度の光源光を得る。
【解決手段】左側プリズム５、左側導光体３、冷陰極管からなる線状光源２、右側導光体４、右側プリズム６が、面状光学体１のシリンドリカルレンズ７、８、９の下方に対応して配置され、冷陰極管２の背面側に反射板１０を備えたバックライト。



リカルレンズ９の集光作用により平行光化され液晶層（上方）へと出射される。

【００２７】面状光学体１、左側導光体３、右側導光体４、左側プリズム５、右側プリズム６には、いずれも光学的に高い透明性を示す高分子材料、ガラスなどを使用する。左側プリズム５、右側プリズム６の斜面には、アルミニウムや銀を蒸着して、光を透過させない良好な反射面を設ける。反射板１０についてもアルミニウムや銀など反射率の高い金属材料を使用することが好ましい。

【００２８】面状光学体１、左側導光体３、右側導光体４、左側プリズム５、右側プリズム６はお互いに接触することなく配置する。この際、部材間の空気層をできる限り薄くすることが好ましい。例えば、０．５～１．５mm程度の空隙を設けるように導光体とプリズムをその端部で支持するように配置すればよい。

【００２９】または、導光体およびプリズムの表面に低屈折率の材料（例えば、屈折率１．３４の物質として、パーフルオロ（ブテニルビニルエーテル）［ＰＢＶＥ］の重合体（数平均分子量約１．５×10^5）、ならびに、屈折率１．２９の物質としてＰＢＶＥとパーフルオロ（２，２－ジメチルー１，３－ジオキソール）［ＰＤＤ］との共重合体（数平均分子量約３×10^5）などがあげられる。）を配置してもよい。基本的には、導光体およびプリズム内部からの光の漏れを抑制するために、全反射条件を満足するように、導光体およびプリズムとそれを取り囲む部材との屈折率差を調整して設けることが好ましい。

【００３０】通常は、導光体およびプリズムはアクリル系樹脂を用い、空気（屈折率≒１．０）で周辺に空隙を設ければ、製造も簡便であり、かつ、損失の少ない良好な光束伝送条件が満たされる。そして、システム全体の光利用効率がさらに向上するからである。また、アレイ状に配置されたシリンドリカルレンズ７、８、９は面状光学体１の一部分であり、空間的に連続する位置関係にある。

【００３１】線状光源２の最上部をシリンドリカルレンズ８の焦点近傍に、左側プリズム５の最上部（光束の進行中心部）をシリンドリカルレンズ７の焦点近傍に、右側プリズム６の最上部（同様に、光束の進行中心部）をシリンドリカルレンズ９の焦点近傍に配置する。左側導光体３は線状光源２と左側プリズム５との間に、右側導光体４は線状光源２と右側プリズム６との間に配置する。また反射板１０は線状光源２の最下部とほぼ接するように配置する。

【００３２】このような光制御機能を有するユニット、すなわち冷陰極管、二つの導光体、二つのプリズム、および、反射板からなるユニットをアレイ状のシリンドリカルレンズを持つ面状光学体に対して、複数並列的に配置すれば、表示面全体に平行光化された出射光を供給するバックライトを実現できる。

【００３３】光源の発光部から出射し、左側導光体３、右側導光体４へとそれぞれ入射した光がそれぞれシリンドリカルレンズ７、シリンドリカルレンズ９を出射するまでの過程においては、導光体と空気との境界における反射、プリズムと空気との境界における反射、プリズム斜面（アルミニウム蒸着面）における吸収により光量が失われるが、その割合は実質的に小さくバックライトとして所望の光束を出すことができる。

【００３４】また反射板１０により反射される光はシリンドリカルレンズ８へは入射せず、ほとんど左側導光体３、右側導光体４へと入射する。したがってシリンドリカルレンズ８より出射される光量と、左右いずれかの導光体とプリズムを経てシリンドリカルレンズ７、シリンドリカルレンズ９より出射される光量との差は少なく、出射光量の表示面内均一性を保つことができる。

【００３５】線状光源２は面状光学体１、左側導光体３、右側導光体４、反射板１０に囲まれるように配置されており、線状光源２より発せられた光のほとんどをシリンドリカルレンズ７、８、９に供給することができ、高い光利用効率を実現することができる。

【００３６】シリンドリカルレンズ７、８、９のサイズを線状光源２や二つのプリズムに対して十分大きくとることにより、バックライトからの出射光の平行度を高めることができ、かつ二次ピーク光の出射を抑えることができる。また本発明の特徴は、複数の部材の組み合わせ方にあり、バックライトを構成する個々の部材は単純な形状を有している。したがって量産に際しても高い生産性が期待される。

【００３７】また本発明の実施に際しては、上記の面状光学体の代わりに他の形態のものを使用することもできる。図４は本発明の他の実施の形態を表す断面図である。図１と異なる点は、面状光学体１の代わりに、両凸のシリンドリカルレンズをアレイ状に配置した面状光学体１１を使用したものである。各シリンドリカルレンズの焦点近傍に、線状光源２の最上部、左側プリズム５の最上部、右側プリズム６の最上部を配置する。

【００３８】図５も本発明の他の実施の形態を表す断面図である。図１と異なる点は、面状光学体１の代わりに、フレネルレンズをアレイ状に配置した面状光学体１２を使用することにある。各フレネルレンズの焦点近傍に、線状光源２の最上部、左側プリズム５の最上部、右側プリズム６の最上部を配置する。この方法は面状光学体の厚さｔを抑制し、超薄型化を達成できるという利点を有している。そして、全体の厚みＤをも薄型化できる。

【００３９】

【実施例】

（実施例１）本例は図１に示す構造のものであり、シリンドリカルレンズの円筒面の半径をｒ＝４mm、面状光学体１の厚さｔ＝８mm、各導光体の幅ａ＝５．９m

ｍ、各導光体の高さｂ＝２ｍｍ、各プリズムの短辺の長さｃ＝２ｍｍ、冷陰極管の直径ｄ＝２ｍｍ、全体の厚みＤ＝１１ｍｍに設定した。

【００４０】一般にレンズが光源導光部（本例の場合、冷陰極管の径やプリズムの寸法）に比べて大きいほど、出射光の平行度は高まる。上記設定値の場合、ｒとｄの比率、あるいはｒとｃの比率は２：１であるが、この条件におけるバックライト出射光の平行度をシミュレーションにより評価した。図６はレンズ半径と光供給源の幅を２：１にした際の出射光の累積光量曲線を示す。

【００４１】累積光量曲線は、出射光量を出射角度について積分したものであり、平行度が高いほど曲線が立ち上がる。光線追跡計算の結果、レンズ半径と光供給源の幅を２：１した際の平行度は、$I = I_0 \cdot \cos^n \theta$ ・・・（式１）において、ｎ＝５０と置いた場合に相当し、高い平行度が得られることを確認した。なお、本発明においてはｎ≧４０となるように構成することが好ましい。

【００４２】式１は一般的な面光源の出射角度別の光度分布を表している。同式において、Ｉは光度、I_0は正面方向の出射光の光度、θは出射角度であり、ｎが大きいほど出射光の平行度が高まる（ｎ＝１とした場合は完全拡散光源）。

【００４３】本例においてはシリンドリカルレンズの円筒面の半径と冷陰極管直径との比率を２：１としたが、実際には求められる平行度、許容できる面状光学体の厚さ、表示面のサイズ、などから最適な寸法を定めればよい。

【００４４】（実施例２）図３に、左右の端部５′、６′、左右の導光本体部３′、４′をそれぞれ一体化した例を示す。本例では光の利用効率が上記実施例よりも若干劣るが、光源導光部の構造が簡素化でき、製造が容易であった。一体化された構造の端部斜面が光路変更手段として機能する。

【００４５】

【発明の効果】本発明によれば、表示面内の明るさの均一性を損ねることなく、バックライト出射光を平行光化することができる。

【００４６】本発明によれば、二次ピーク光の出射を抑えながら、バックライト出射光を平行光化することができる。

【００４７】本発明によれば、光利用効率を低下させることなく、バックライト出射光を平行光化することができる。

【００４８】本発明によれば、比較的簡単な形状を有する面状光学体の組み合わせにより、バックライト出射光を平行光化することができる。そして、超薄型化を達成でき、表示装置の小型化に寄与できる。また、光源の総合効率を大幅に向上でき、少ない光源パワーであっても、良好な表示を提供でき、電池動作であっても、その有効時間を長くすることができる。

【００４９】また、本発明によれば、バックライトの厚みを増すことなく、バックライト出射光を平行光化することができる。また、本発明はその効果を損しない範囲で種々の応用ができる。

【図面の簡単な説明】

【図１】本発明の実施例１のバックライトの断面図。

【図２】本発明によるバックライトを構成する光源導光部の光路を示す部分拡大断面図。

【図３】本発明の実施例２（導光体とプリズム一体型）の断面図。

【図４】本発明の他の例（両凸シリンドリカルレンズ）の断面図。

【図５】本発明の他の例（フレネルレンズ）の断面図。

【図６】光線追跡により求めたバックライト出射光の累積光量曲線。

【図７】プリズムシートを用いる従来例１の断面図。

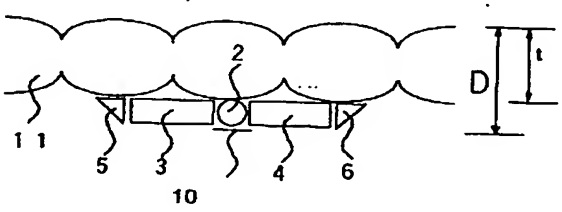
【図８】球面レンズを導光体に接着する従来例２の断面図。

【図９】シリンドリカルレンズと光源光の分割を行なう従来例３の断面図。

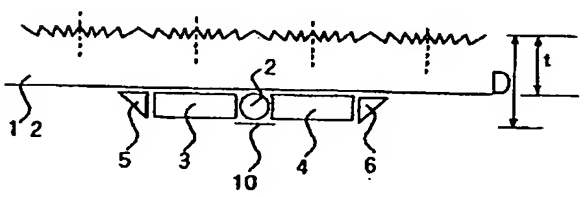
【符号の説明】

１、１１、１２：面状光学体
２：線状光源
３：左側導光体
４：右側導光体
５：左側プリズム
６：右側プリズム
７、８、９：シリンドリカルレンズ
１０：反射板

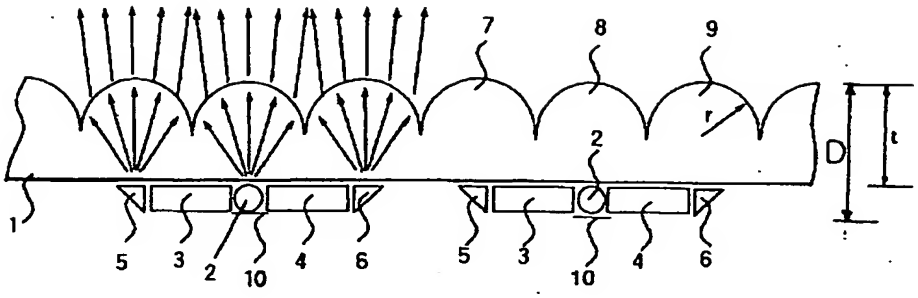
【図４】



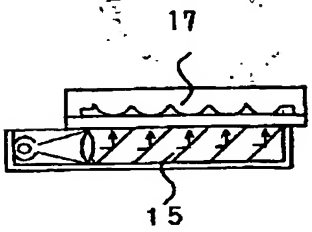
【図５】



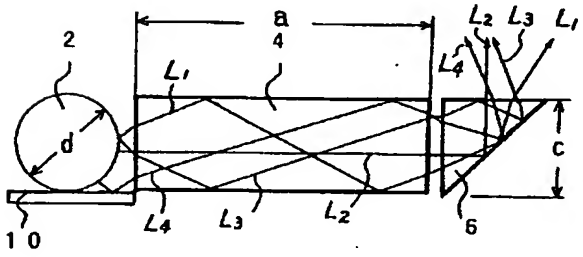
【図１】



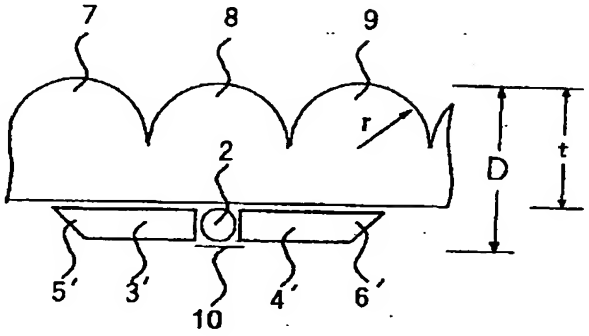
【図9】



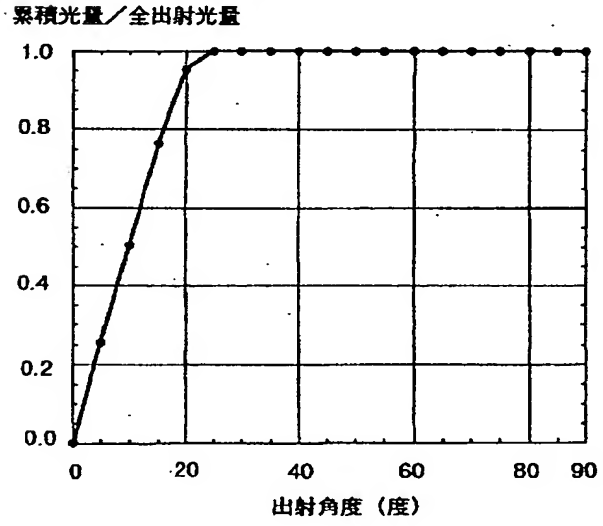
【図２】



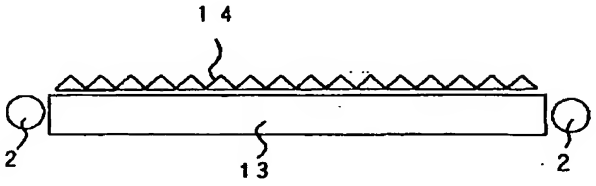
【図３】



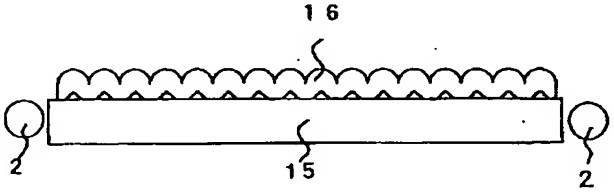
【図６】



【図７】



【図８】



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